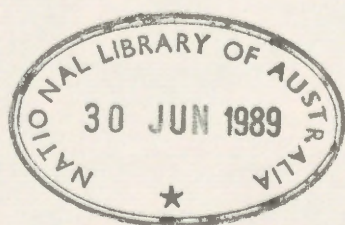




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DOMESTIC FALLOUT SHELTER GUIDE

DEPARTMENT OF DEFENCE
NATURAL DISASTERS ORGANISATION



Contents

DEPARTMENT OF DEFENCE NATURAL DISASTERS ORGANISATION

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DOMESTIC FALLOUT SHELTER GUIDE

Acknowledgments

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Contents

Introduction 1

General 1

Protective design 2

Shelter construction and improvisation 3

Shelter ventilation 3

Shelter equipment 5

Important note 5

Recommended equipment for shelter occupation 6

Shelter plans 9

Type A Concrete below ground 10

Type B Concrete above ground 12

Type C Concrete under house 14

Type D Steel below ground 16

Type E Timber below ground 18

Type F Timber above ground 20

Type G Timber under house 22

Type H Concrete under house 24

Expedient outdoor shelter plans 27

Door-covered trench shelter 28

Above ground door-covered shelter 30

Log-covered trench shelter 33

Instructions for making a shelter-entry canopy 35

Air ventilation pump 36

Shielding

The level of radiation from fallout decreases relatively rapidly with time. If shelter is sought quickly after an explosion, protection can be afforded by cover of dirt, sand, earth or other dense material. For example reinforced concrete provides approximately five times the protection afforded by wood. A thickness of 400 mm of concrete would be necessary for adequate protection against the initial level. This would give a protection factor of about 100, i.e. radiation inside a shelter would be 1 per cent of that in an exposed position.

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Revised 1964

This work is a reprint of the original work published in 1964. It contains the same material as the original work, but with some minor corrections and updates. The work is a reprint of the original work published in 1964. It contains the same material as the original work, but with some minor corrections and updates.

Shelter construction and improvisation	1
Shelter ventilation	3
Shelter equipment	5
Important notes	5
Recommended equipment for shelter occupation	5
Shelter plans	9
Type A Concrete below ground	10
Type B Concrete above ground	12
Type C Concrete under house	14
Type D Steel below ground	16
Type E Timber below ground	18
Type F Timber above ground	20
Type G Timber under house	22
Type H Concrete under house	24
Expedient outdoor shelter plans	27
Door-covered trench shelter	28
Above ground door-covered shelter	30
Log-covered trench shelter	32
Instructions for making a shelter-entry canopy	35
Air ventilation pump	38



Introduction

This pamphlet is issued to give some guidance to those who may wish to plan domestic fallout shelter space at moderate cost.

General

In the event of the detonation of a nuclear device on or near the ground, people outside the blast area could be endangered by the radiation emitted from radioactive fallout.

When and where fallout will occur is dependent upon a number of factors, such as the location and height above ground of the burst, the prevailing weather conditions at the time and the strength and direction of the winds following the detonation.

Fallout

If the fireball from the explosion of a nuclear device touches the earth, vaporised materials will be drawn up into the nuclear cloud. This cloud becomes radioactive and the fallout particles may be deposited over considerable distances. The extent and shape of the contaminated area will depend on prevailing weather conditions following the explosion.

Radiation

The gamma rays emitted by radioactive fallout are the most dangerous type of nuclear radiation and are undetectable to human senses, but may be detected and measured with radiological instruments.

Exposure to gamma radiation can cause damage to the cell structure of the human body. If the exposure is limited to small doses the normal body processes can repair the damage caused, but if there is exposure to large doses of radiation irreparable damage and death may result.

Shielding

The level of radiation from fallout decreases relatively rapidly with time. If shelter is sought quickly after an explosion, protection can be afforded by cover of concrete, earth or other dense material. For example, reinforced concrete provides approximately five times the protection afforded by wood. A thickness of about 400 mm of concrete would be necessary for adequate protection above ground level. This would give a protection factor of about 100, i.e. radiation dose received inside such a shelter would be 1 per cent of that in an exposed position.

Depending on the time elapsed since the explosion and intensity of the radiation from fallout, it may be necessary to take shelter for a period of two days up to a period of two weeks.

Fallout shelters

The sketches in Figures 1 and 2 indicate the basic principles involved in providing shielding from gamma radiation. The lightweight wall and roof structure shown in Figure 1 permits the entry of a greater proportion of radiation than the heavier or multiple roof, floor and wall systems shown in Figure 2.

A simple concrete structure that will provide adequate protection above ground level would have reinforced concrete walls and roof 400 mm thick. This however, is not the most economical solution to the problem, so a combination of various materials and methods of construction are used to provide a suitable shelter that will have the same level of protection while keeping the costs within an acceptable range.

There are two main approaches recommended for providing a fallout shelter for a family. The first of these is the use of protective design in housing construction and the other is the construction of separate shelters or improvisation to provide shelter. Each of these approaches is dealt with briefly in this booklet.

Protective design

Protective design, as the name implies, is the incorporation of features in an initial building design to provide adequate protection from the effects of fallout gamma radiation.

Protection may be incorporated without adversely affecting the appearance or normal function of the dwelling and without causing any large increase in the cost.

The use of building materials and the special arrangement of the building spaces to enhance radiation protection are the main factors in providing adequate protection in fallout shelters.

It is important that if fallout shelter space is to be provided in a dwelling, without adversely affecting its function or beauty, it should be considered in the basic design stage and should be included as an integral part of the building concept. Its function as a shelter should also be an alternative to the primary function for which the space is intended. Thus the space will have a normal full-time use, but may be used as a shelter in an emergency.

The design shown on Figure 10 indicates how a suitable shelter area can be included in the layout of the garage incorporated in a dwelling. The normal function of this space would be to provide secondary toilet facilities and a store room, opening directly off the garage. This is one example of what can be done to provide fallout shelter, but of course it will not apply to all circumstances and some variation will be necessary in most cases.

Shelter construction and improvisation

Of all the dense materials, the cheapest and most readily available is earth. This can be used in conjunction with such materials as concrete, concrete blocks, concrete pipes, steel sheeting and timber framing to provide a suitable mass of material to afford shelter from fallout radiation and yet keep the cost factor within acceptable limits.

Some designs are included in this booklet, together with a materials list for each. These designs include separate shelters and improvised shelters in existing buildings. In each case the protection factor of the fallout shelter is in excess of 100.

To ensure that the completed shelter is safe both structurally and as a fallout shelter, it is essential that care be exercised in maintaining the shelter dimensions and material sizes and thicknesses as set out in this booklet.

Any variations to the dimensions of the shelters or combination of materials would necessitate a reanalysis of the shelter from both the radiation and structural points of view.

Adequate consideration should be given to ensuring that the shelter's interior remains dry. Where necessary, such procedures as perimeter and sub-grade drainage, water proofing and damp proofing will be required.

Shelter ventilation

There are four major requirements imposed upon a shelter ventilation system. It should prevent contamination of the air inside the shelter by fallout dust; it should control body odours and odours from food and sanitary facilities; enough fresh air should be circulated to control the temperature and humidity within tolerable limits; and most importantly adequate ventilation is required to prevent oxygen depletion and carbon dioxide build-up.

These requirements apply to sealed shelters (i.e. with a permanent door closure). Shelters which depend on natural ventilation should also be planned so that air movement through the shelter will be possible. They apply to the shelters in this booklet with the exception of Type G Timber Under house (Figure 9) and those in the expedient shelter section.

Air intake

Ventilation systems should be so designed that the outside air intake opening is positioned not less than 660 mm above any surface on which radioactive fallout could be deposited. The air intake opening should be hooded and positioned to prevent deposits of radioactive fallout on the intake face.

Filters

Special filters are not required for ventilation systems of fallout shelters. Normal commercial filters are adequate. No filters are required for fallout shelter ventilation equipment if the face velocity at the outside air intake is less than 45 metres per minute.

Air pump

The shelter ventilation system must be designed to provide the ventilation rates required during periods when normal electric power is not available. Electrically operated air pumps should be supplied with their own generator which must be sited outside the living area of the shelter with its own ventilation and exhaust. All air pumps must be capable of manual operation.

Air requirements

A minimum of 85 litres per minute of fresh air per fallout shelter occupant should be provided to prevent oxygen depletion and carbon dioxide build-up in the fallout shelter. This 85 litres per minute is necessary for maintaining the carbon dioxide concentration at less than 0.5 per cent by volume. The pump must be capable of delivering this amount of air for each person in the shelter against the resistance of the air inlet cowl, any filters and pipework with allowance for possible increase at inlet cowl for partial blockage, filter resistance through dust build-up and internal pressure being above atmospheric. It is advisable to install a pump of more than adequate capacity to avoid the necessity for continual operation. Ideally a pump that requires operating only for five minutes in every fifteen minutes should be installed.

Humidity and temperature

The ventilation rates capable of maintaining safe levels of oxygen and carbon dioxide in the shelter will not necessarily maintain the temperature and humidity at an ideal level. The rise in temperature and humidity will depend on the external conditions, the construction of the shelter, the surrounding soil conditions and the number of shelter occupants. The above air flow rates should maintain tolerable conditions in the cooler areas of Australia, but in tropical areas a much higher ventilation rate will be necessary.

Blast and exhaust valves

In steel and concrete underground shelters which provide a degree of blast protection, this may be enhanced by the inclusion of a blast valve on the air intake line and a pressure relief discharge valve in the exhaust line. These will provide protection for the occupants from shock waves and high pressure increases. If these valves are not included, some means of temporarily sealing the intake and exhaust should be included to allow the shelter to be temporarily sealed in the event of overhead fires.

Shelter equipment

As the estimated period of occupancy may extend to fourteen days it will be necessary to equip the shelter with various items needed to sustain the day to day living of the occupants for the required period.

Water

Drinking water to be stored within the shelter to provide each occupant with a minimum of 14 litres.

Food

Foodstuffs to be stored within the shelter in sufficient quantity to provide each occupant with 10 000 calories.

Sanitation

A suitable type of chemical toilet should be provided, located in such a manner as to minimise the circulation of odours within the shelter.

Sundry items

Such items as first aid kit, battery-operated wireless, battery-operated torches, blankets, eating utensils, shovel and crowbar will also need to be included in the shelter's equipment, together with such items as may be deemed necessary by the occupants to maintain a stay of the required duration. A suggested list follows, to which should be added items required by particular occupants.

Important note:

Before proceeding to build any fallout shelter, State or Territory authorities should be consulted and the required local government authority approval should be obtained. Initial inquiries should be made with the State or Territory Emergency Service.

Recommended equipment for shelter occupation

Personal equipment

Wallet containing personal papers such as: identity cards, valuables, money, blood group card etc.

Strong clothing (according to climate), personal linen

Heavy shoes

Toilet articles, razor, soap, toothbrush

Gas mask (if appropriate)

Cooking facilities, tableware, tin opener, thermos

Flashlight, candles, matches, writing materials, spare batteries

Sewing and mending kit

Prescription drugs, spare spectacles

Woollen blankets

Toys for children, books and games

All this should be packed in a rucksack or small suitcase



Material and tools

Sitting and sleeping facilities (on 2–3 levels)

Emergency lighting

Battery-operated radio receiver, spare batteries

Assorted cleaning materials (soap and other products), makeshift toilet (plastic bags)

Material for shelter outfitting (nails, screws, hammer, pliers, saw, wire, hosepipe, rule, hatchet, screwdriver, slats and wall plates)

Excavation tools to open blocked exits (pickaxe, shovel, crow bar)



Food reserves

(according to the way of life)

Water reserves in bottles and hermetically sealed receptacles, preferably not in glass bottles as these can smash (mineral water)

Condensed and powdered milk

Ground coffee in tins, tea, cocoa

Chocolates, refreshing sweets

Tinned meat, fish etc.

Packaged cheese

Tinned fruit and vegetables

Dried fruit, glucose

Bread, crisp bread, rusks

Sugar, salt, flour, butter, fat or oil

Honey, jam, fruit juice

Rice, noodles, semolina, oat flakes, lentils

Potatoes, vegetables, fruit (in plastic bags)



Medical stores

Triangles, slings, dressings, gauze, bandages, compresses, cotton wool, dressings for burns

Elastic bandages, plasters

Safety pins, scissors, forceps

Thermometer

Ointment for burns

Disinfectants

Alcohol and pure benzine, boiled water

Anti-shock remedies, tranquillisers, sleeping pills, sedatives

Splints and bandages

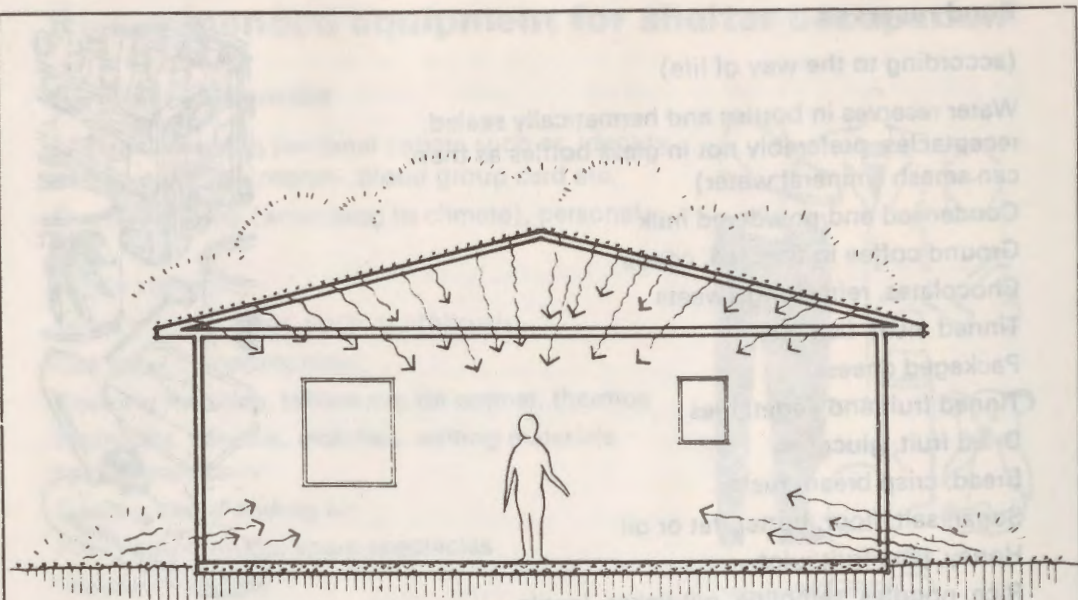
Material for makeshift stretcher

Woollen blankets, old sheets

Damp tissues

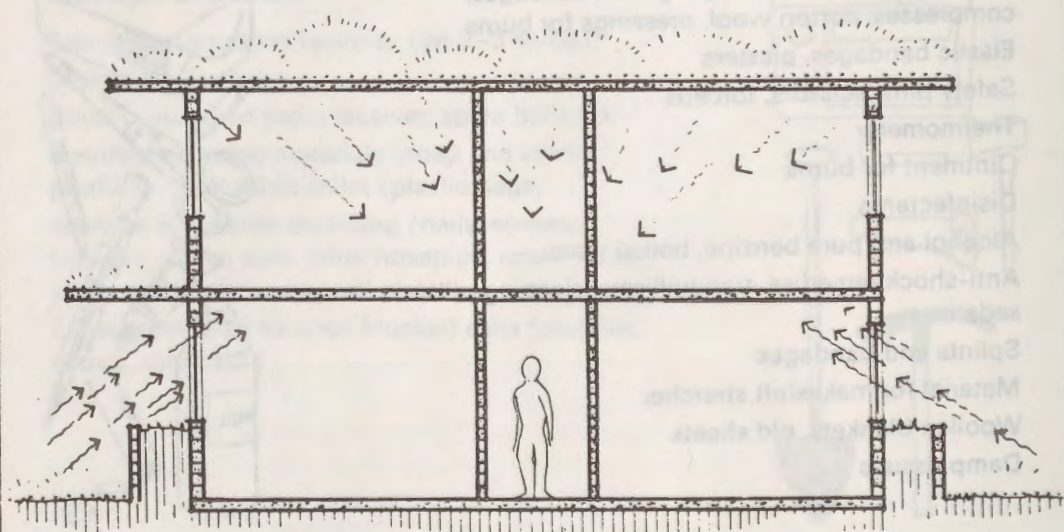


(The list is also useful in case of evacuation.)



Lightweight construction

FIGURE 1

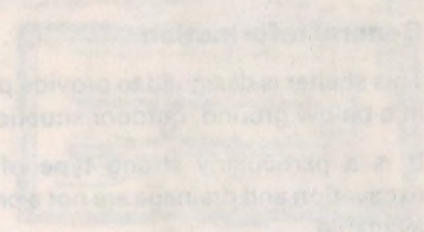


Concrete slab, brick wall structure

FIGURE 2

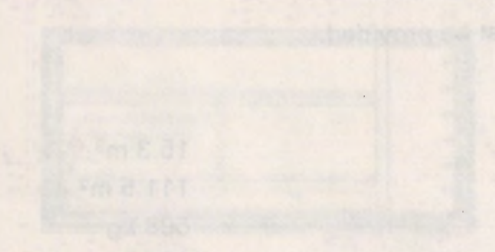
Shelter plans

The shelter is designed to provide protection from the effects of radioactive fallout. It is a portable unit and is suitable for any size where necessary and the appropriate materials are readily available. The shelter is made of steel and concrete and is designed to provide protection from the effects of radioactive fallout. It is a portable unit and is suitable for any size where necessary and the appropriate materials are readily available.



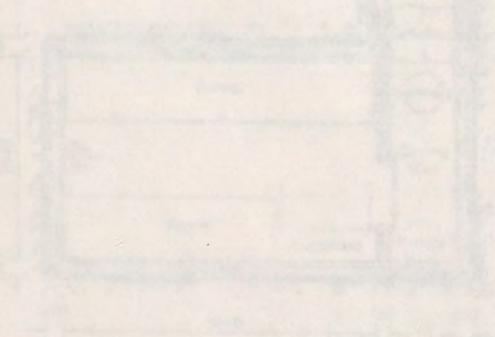
Technical summary

Space and occupancy: This shelter has 3 m² of floor area, 18.9 m² of space, plus lock for entry, sanitation and refuse bins. Accommodates maximum capacity: Six persons. Radiation protection factor: The shelter is designed to provide a protection factor of about 500. Lock: Lock is provided for entry and exit. Ventilation: Mechanical ventilation must be provided for the shelter.

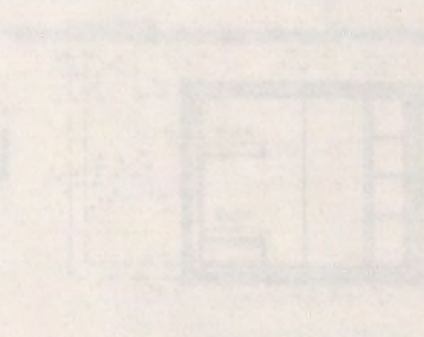


- 153 kg
- 83.0 m²
- 87.8 m²
- 80.3 m²
- No. 1
- No. 8
- No. 1
- No. 1
- No. 32

- List of required materials
- Concrete
- Reinforcing steel
- 10 mm dia. round steel reinforcement
- F102 fabric reinforcement
- F12 fabric reinforcement
- 0.2 mm polythene membrane
- Steel hatch cover and frame
- Steel step ions
- 5030 mm high x 810 mm sliding door complete with track
- Mechanical ventilation system
- General sundage



PLAN



SECTION C-C

Type A Concrete below ground

General information

This shelter is designed to provide protection from the effects of radioactive fallout in a below ground, outdoor situation.

It is a particularly strong type of shelter and is suitable for any area where excavation and drainage are not a problem and the appropriate materials are readily available.

Technical summary

Space and occupancy. This shelter has 9.3 m² of floor area, 18.9 m³ of space, plus lobby for entry, sanitation and refuse kits.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor of about 3000 if entry is properly sandbagged.

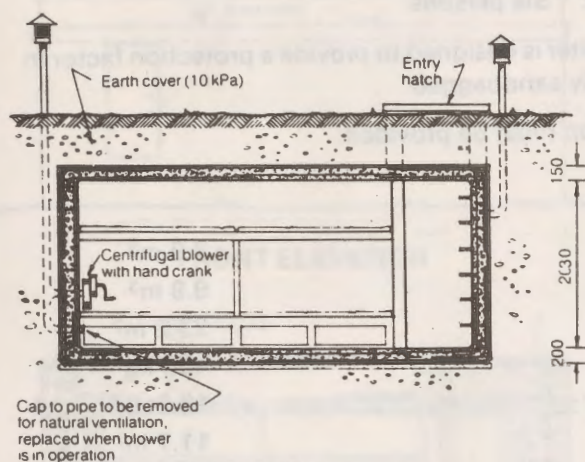
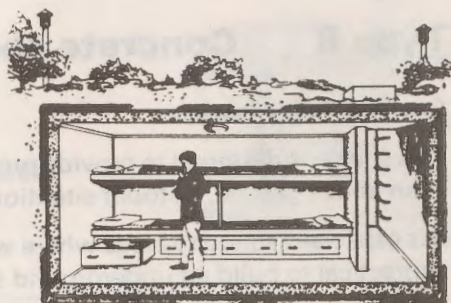
Ventilation. Mechanical ventilation must be provided.

List of required materials

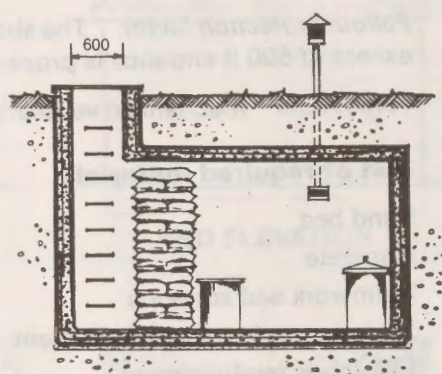
Concrete	15.3 m ³
Formwork and supports	111.5 m ²
12 mm dia. round steel reinforcement	508 kg
10 mm dia. round steel reinforcement	127 kg
F102 fabric reinforcement	53.0 m ²
F72 fabric reinforcement	51.8 m ²
0.2 mm polythene membrane	80.3 m ²
Steel hatch cover and frame	No. 1
Steel step irons	No. 9
2030 mm high × 810 mm sliding door complete with track	No. 1
Mechanical ventilation system	No. 1
Standard sandbags	No. 32

Type A

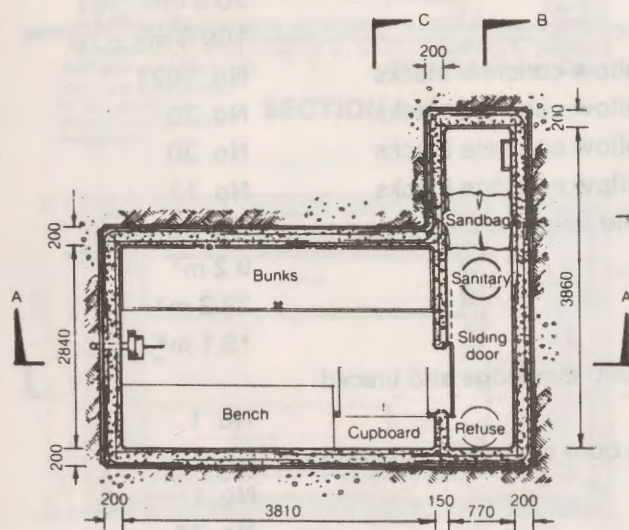
Reinforced concrete, earth covered



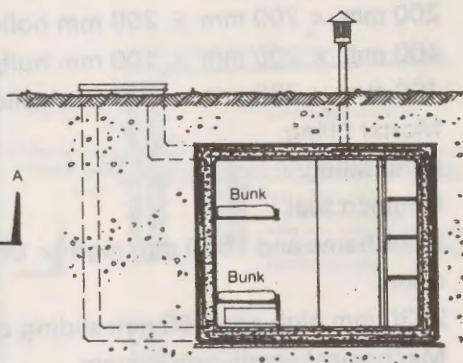
SECTION A-A



SECTION B-B



PLAN



SECTION C-C

Type B Concrete above ground

General information

This shelter is designed to provide protection from the effects of radioactive fallout in an above ground, outdoor situation.

It is especially suited to areas where water or rock is close to the surface, making it impractical to build an underground shelter.

Technical summary

Space and occupancy. This shelter has 9.4. m² of floor area, 19.0 m³ of space, plus lobby for entry, sanitation and refuse kits.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor in excess of 600 if entrance is properly sandbagged.

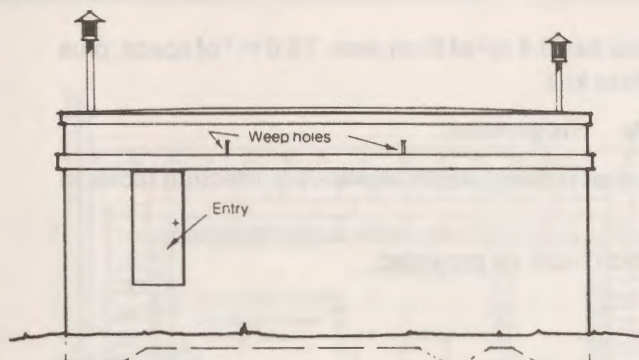
Ventilation. Mechanical ventilation must be provided.

List of required materials

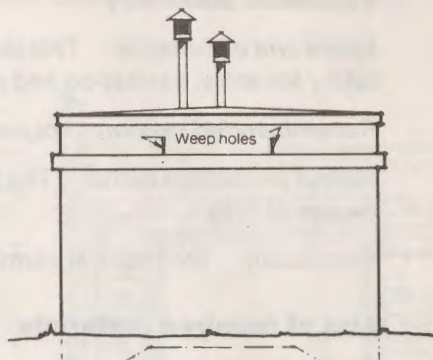
Sand bed	2.3 m ³
Concrete	9.9 m ³
Formwork and supports	23.2 m ²
12 mm round steel reinforcement	458 kg
F81 fabric reinforcement	13.3. m ²
F918 fabric reinforcement	11.7 m ²
F928 fabric reinforcement	30.1 m ²
F82 fabric reinforcement	12.6 m ²
F72 fabric reinforcement	20.9 m ²
0.2 mm polythene membrane	109.5 m ²
400 mm × 200 mm × 200 mm hollow concrete blocks	No. 1021
300 mm × 200 mm × 200 mm hollow concrete blocks	No. 20
200 mm × 200 mm × 200 mm hollow concrete blocks	No. 30
400 mm × 200 mm × 100 mm hollow concrete blocks	No. 12
400 mm × 200 mm × 100 mm solid concrete blocks	No. 48
Mortar filling	9.2 m ³
Earth filling	22.2 m ³
Bitumen seal	19.1 m ²
Door frame and 1520 mm high × 660 mm ledge and braced door	No. 1
2030 mm high and 860 mm sliding door complete with track	No. 1
Mechanical ventilation system	No. 1
Standard sandbags	No. 36

Type B

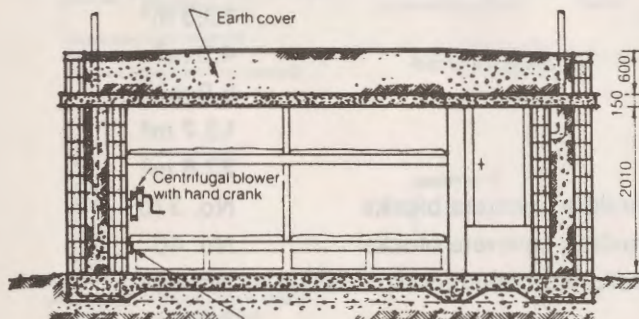
Reinforced concrete floor and ceiling, concrete block walls



FRONT ELEVATION

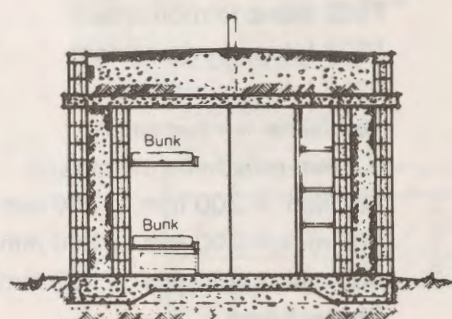


END ELEVATION

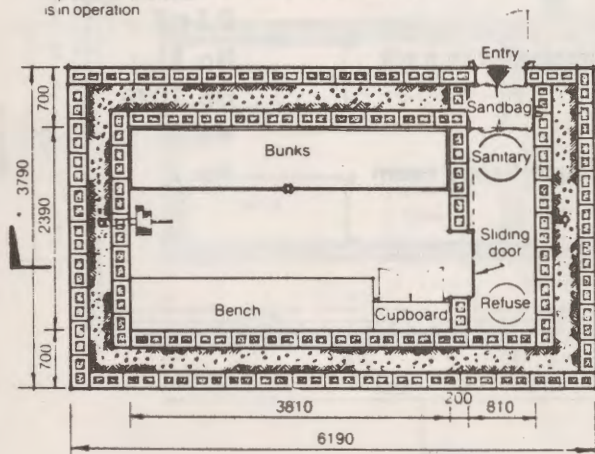


Cap to pipe to be removed for natural ventilation, replaced when blower is in operation

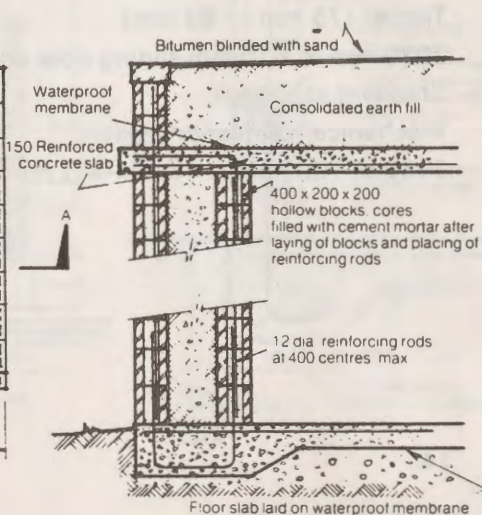
SECTION A-A



SECTION B-B



PLAN



DETAILED SECTION THRO' FLOOR, WALL AND ROOF

Type C Concrete under house

General information

This shelter is designed to provide protection from the effects of radioactive fallout in an under house situation.

It is suitable for a location under an existing dwelling where there is a head room of approximately 2740 mm under the floor joists.

Technical summary

Space and occupancy. This shelter has 9.4 m² of floor area, 19.0 m³ of space, plus lobby for entry, sanitation and refuse kits.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor in excess of 500.

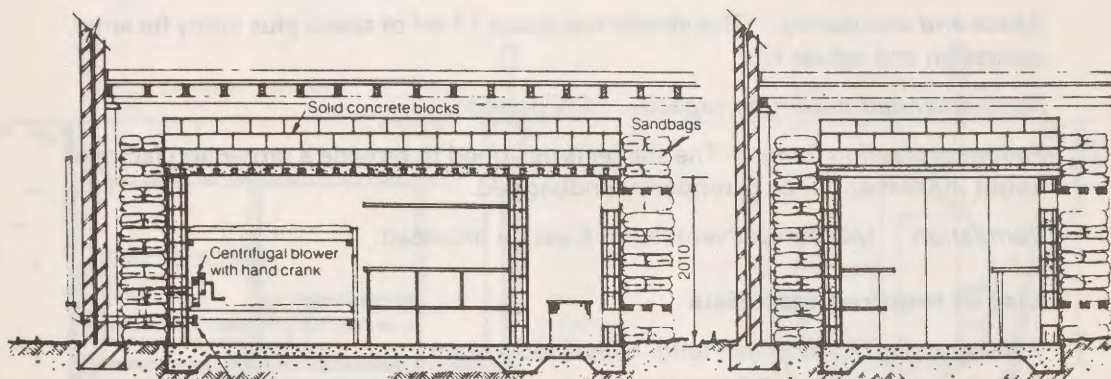
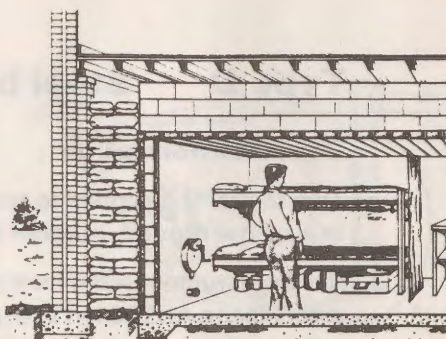
Ventilation. Mechanical ventilation must be provided.

List of required materials

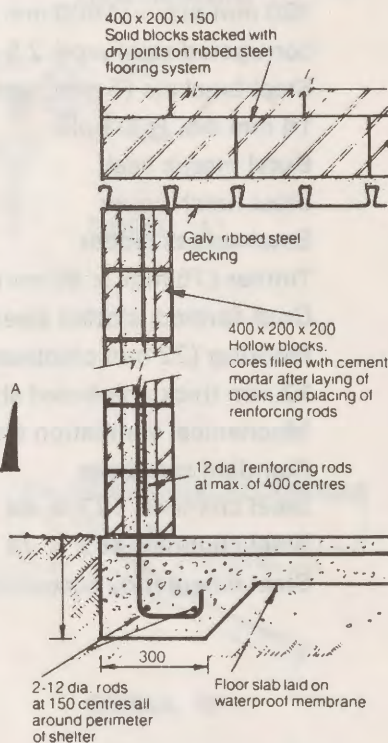
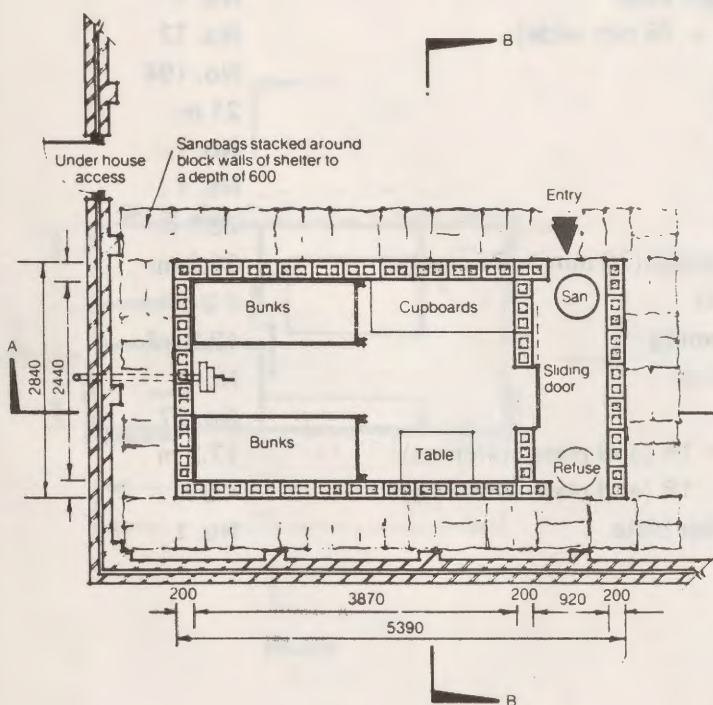
Concrete	5.65 m ³
12 mm round steel reinforcement	203.2 kg
F102 fabric reinforcement	13.3 m ²
F828 fabric reinforcement	4.2 m ²
F918 fabric reinforcement	5.9 m ²
F62 fabric reinforcement	15.7 m ²
0.2 mm polythene membrane	27.6 m ²
400 mm × 200 mm × 200 mm hollow concrete blocks	No. 370
200 mm × 200 mm × 200 mm hollow concrete blocks	No. 40
400 mm × 200 mm × 150 mm solid concrete blocks	No. 567
Mortar filling	3.4 m ³
1 mm Bondek	15.0 m ²
Timber (75 mm × 50 mm)	0.2 m ³
2030 mm × 810 mm sliding door complete with track	No. 1
Standard sandbags	No. 1020
Mechanical ventilation system	No. 1
1160 of 102 mm × 45 mm × 7 mm taper flange beam	No. 2

Type C

Hollow concrete block walls, reinforced concrete floor. Solid concrete block roof, supported on galvanised ribbed steel decking



Cap to pipe to be removed for natural ventilation, replaced when blower is operated



DETAILED SECTION THRO' FLOOR, WALL & ROOF

Type D Steel below ground

General information

This shelter is designed to provide protection from the effects of radioactive fallout in a below ground, outdoor situation.

It is constructed in the form of a 2400 mm dia. pipe using galv. helical lock-seam steel pipe to AS1761-1979; a wooden floor is placed across the bottom to provide a flat walking space inside the shelter.

Technical summary

Space and occupancy. This shelter has about 17 m³ of space plus lobby for entry, sanitation and refuse kits.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor of about 3000 if entrance is properly sandbagged.

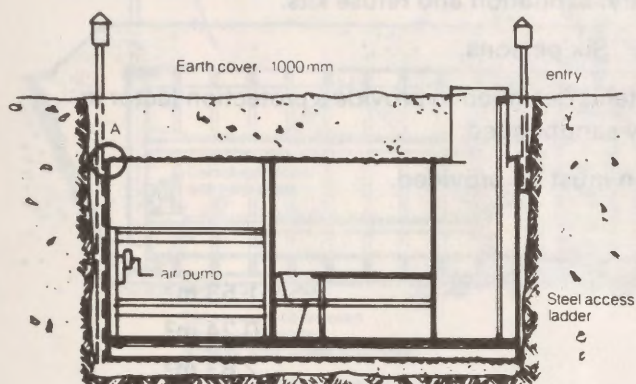
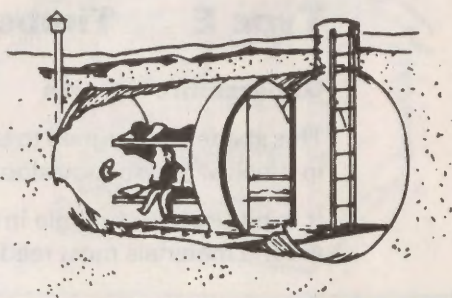
Ventilation. Mechanical ventilation must be provided.

List of required materials

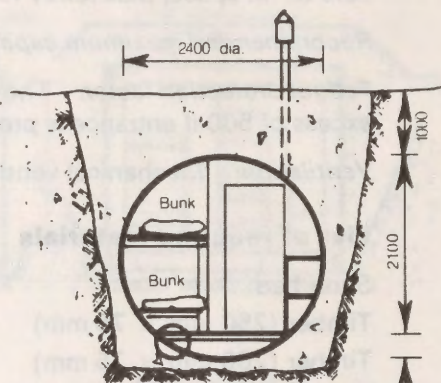
2400 mm dia. × 4800 mm long, helical lock-seam corrugated steel pipe, 3.5 mm thick	No. 1
6 mm gauge steel 2400 mm dia. end wall section	No. 2
750 mm dia. × 1500 mm long helical lock-seam corrugated steel pipe, 2.5 mm thick	No. 1
Steel brackets (6 mm thick × 75 mm wide)	No. 72
16 mm dia. H.T. bolts	No. 194
Butyl mastic seal	21 m
Steel hatch cover	No. 1
Steel access ladder	No. 1
Timber (75 mm × 50 mm)	23.1 m
Cold-formed, slotted steel angle (75 mm × 75 mm)	36.3 m
Flooring (22 mm chipboard)	7.2 m ²
12 mm thick chipboard sheeting	13.3 m ²
Mechanical ventilation system	No. 1
Standard sandbags	No. 27
Steel channels 127 × 64 × 15 (end plate stiffeners)	17.2 m
Steel channels 152 × 76 × 18 (end plate stiffeners)	4.3 m
Steel emergency access cover plate	No. 1

Type D

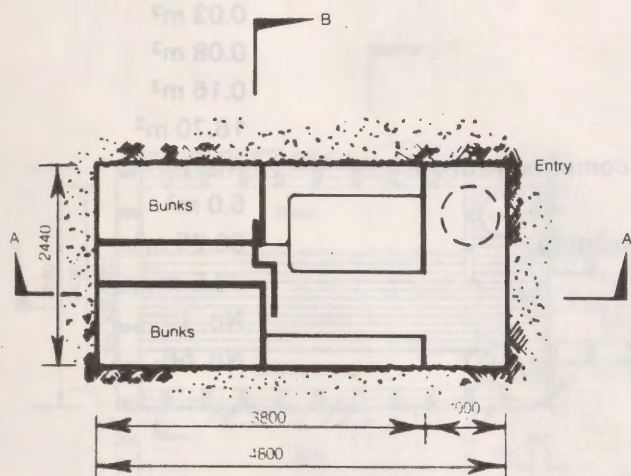
Corrugated galvanised helical lock seam steel pipe
earth covered



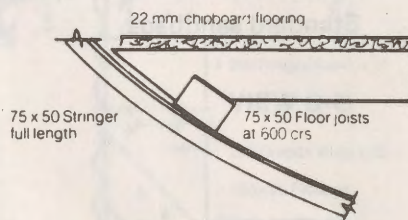
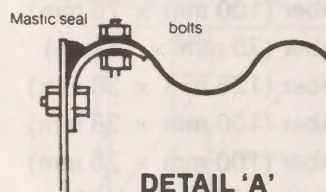
SECTION A-A



SECTION B-B



PLAN



Type E Timber below ground

General information

This shelter is designed to provide protection from the effects of radioactive fallout in a below ground, outdoor situation.

It is particularly suitable in an area where timber and corrugated galvanised steel are the materials most readily available.

Technical summary

Space and occupancy. This shelter has 9.7 m² of clear floor area, approximately 19.8 m³ of space, plus lobby for entry, sanitation and refuse kits.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor in excess of 500 if entrance is properly sandbagged.

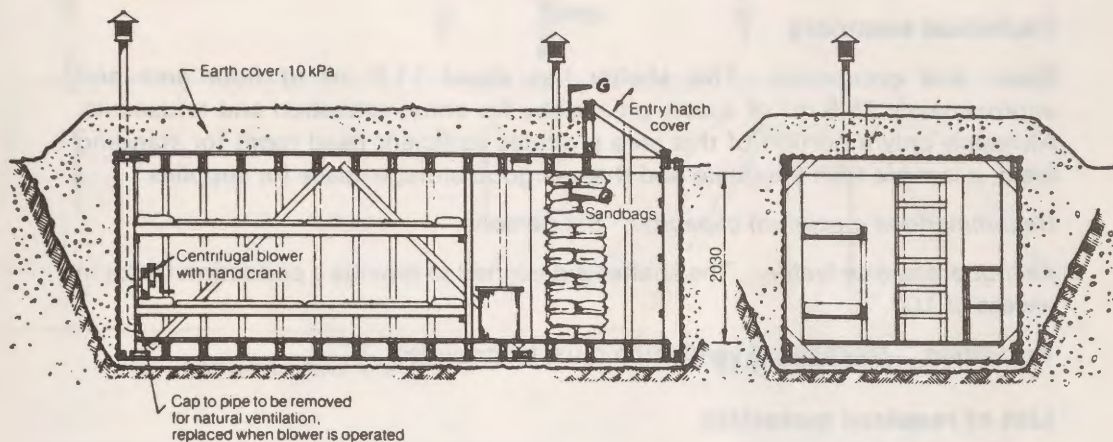
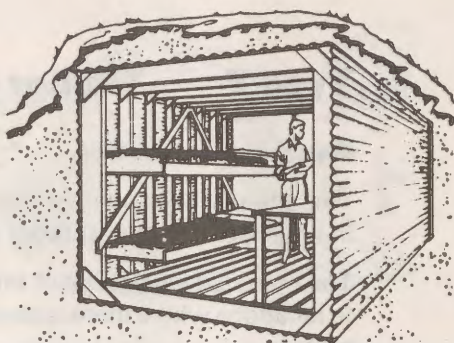
Ventilation. Mechanical ventilation must be provided.

List of required materials

Sand bed	1.53 m ³
Timber (250 mm × 75 mm)	0.24 m ³
Timber (200 mm × 75 mm)	2.83 m ³
Timber (200 mm × 50 mm)	0.31 m ³
Timber (125 mm × 50 mm)	0.04 m ³
Timber (100 mm × 75 mm)	0.03 m ³
Timber (75 mm × 75 mm)	0.21 m ³
Timber (125 mm × 38 mm)	0.03 m ³
Timber (100 mm × 38 mm)	0.08 m ³
Timber (100 mm × 25 mm)	0.16 m ³
Flooring (100 mm × 25 mm)	16.70 m ²
2030 mm × 810 mm sliding door complete with track	No. 1
5 mm thick hardboard sheeting	5.0 m ²
1.6 mm standard corrugated iron sheeting	88.25 m ²
Ridge capping	33.5 m
Mechanical ventilation system	No. 1
Standard sandbags	No. 56

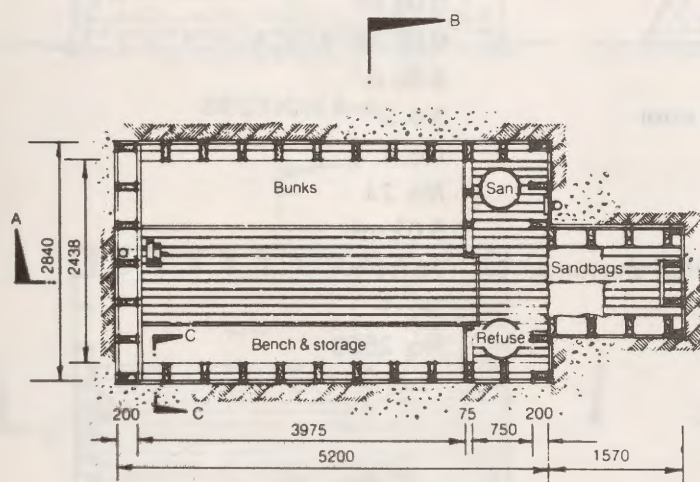
Type E

Timber and corrugated galvanised steel sheets,
earth covered

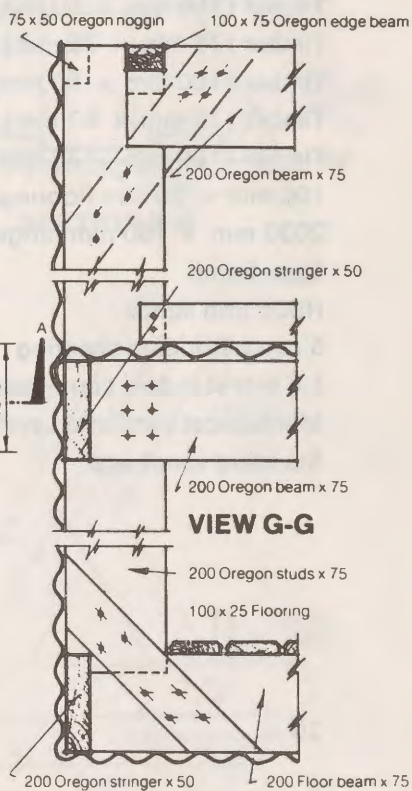


SECTION A-A

SECTION B-B



PLAN



VIEW G-G

VIEW C-C

Type F Timber above ground

General information

This shelter is designed to provide protection from the effects of radioactive fallout in an above ground, outdoor situation.

The principal advantage of this shelter is that it can be erected without excavation in locations where there is poor drainage or where ground water table is close to the surface.

Technical summary

Space and occupancy. This shelter has about 11.0 m² of floor area and approximately 25.5 m³ of space, plus lobby for entry, sanitation and refuse kits. Although only a portion of this area provides sufficient head room for standing erect, it is more than adequate and there is good storage space for supplies.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor in excess of 100.

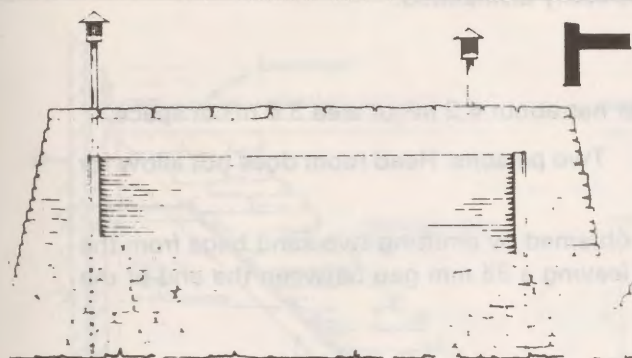
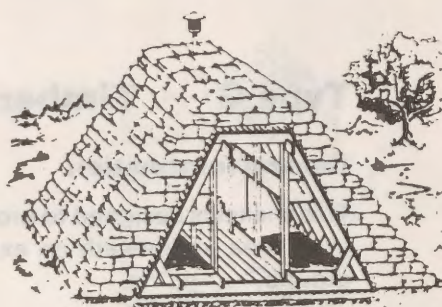
Ventilation. Mechanical ventilation must be provided.

List of required materials

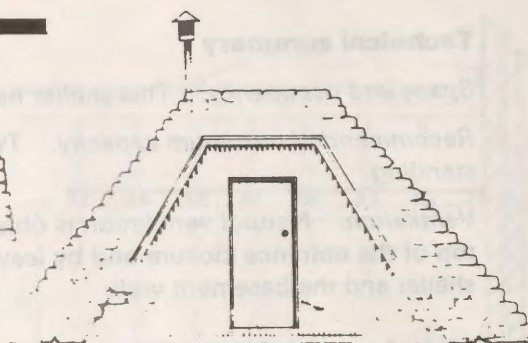
Sand bag	2.30 m ³
Timber (200 mm × 50 mm)	0.09 m ³
Timber (150 mm × 50 mm)	1.90 m ³
Timber (75 mm × 75 mm)	0.15 m ³
Timber (100 mm × 50 mm)	0.07 m ³
Timber (75 mm × 50 mm)	0.03 m ³
Timber (100 mm × 38 mm)	0.06 m ³
100 mm × 25 mm flooring	9.30 m ²
2030 mm × 760 mm hinged door	No. 2
Door frame	No. 1
Hoop iron straps	No. 24
5 mm hardboard sheeting	5.02 m ²
1.6 mm standard corrugated iron sheeting	78.04 m ²
Mechanical ventilation system	No. 1
Standard sandbags	No. 2500

Type F

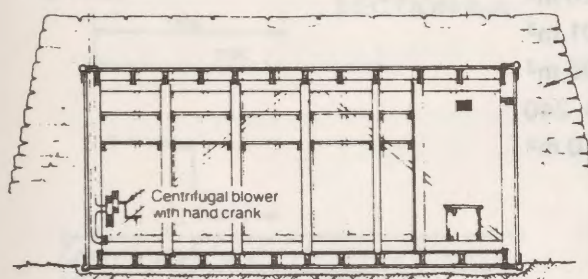
Timber and corrugated steel sheets and sandbags



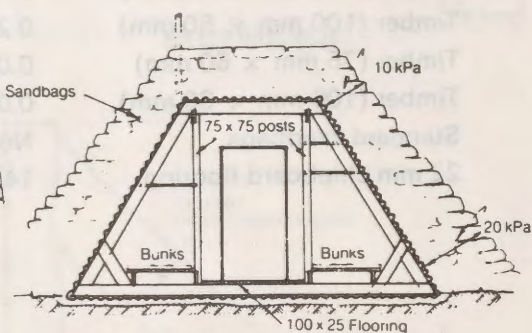
SIDE ELEVATION



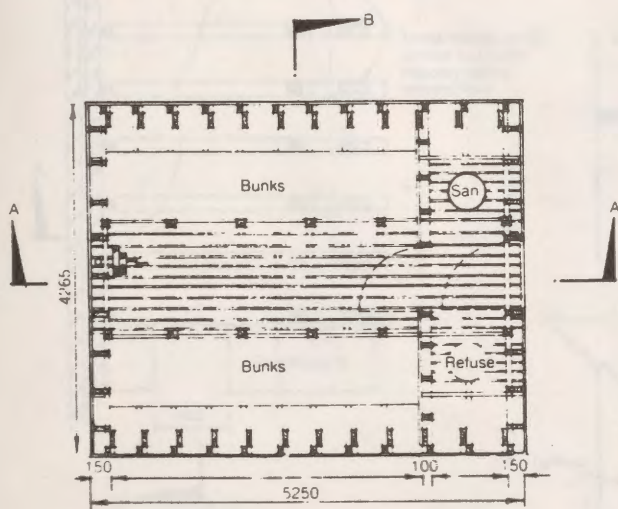
END ELEVATION



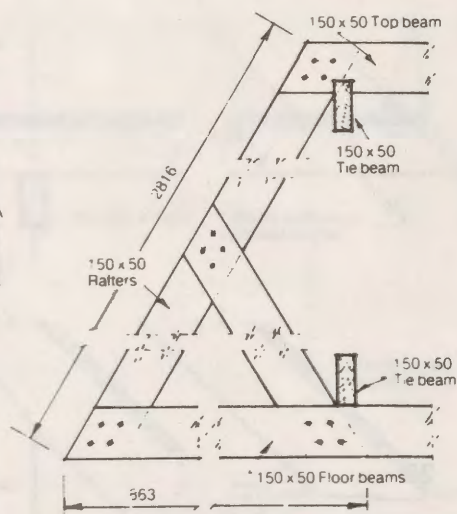
SECTION A-A



SECTION B-B



PLAN



DETAIL THRO' 'A' FRAME MEMBERS

Type G Timber under house

General information

This shelter is designed to provide protection from the effects of radioactive fallout in an area underneath an existing structure where at least two walls are below ground.

Its advantages are low cost, simplicity of construction, general availability of materials, and the fact that it may be easily dismantled.

Technical summary

Space and occupancy. This shelter has about 4.2 m² of area 3.6 m³ of space.

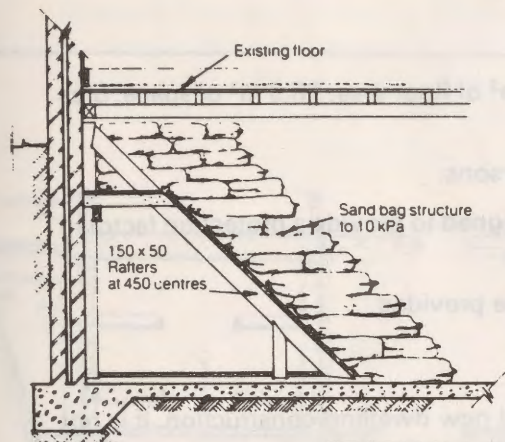
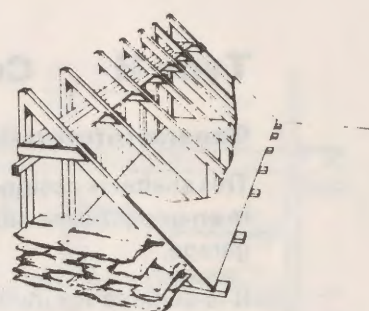
Recommended maximum capacity. Two persons. Head room does not allow for standing.

Ventilation. Natural ventilation is obtained by omitting two sand bags from the top of the entrance closure and by leaving a 38 mm gap between the end of the shelter and the basement wall.

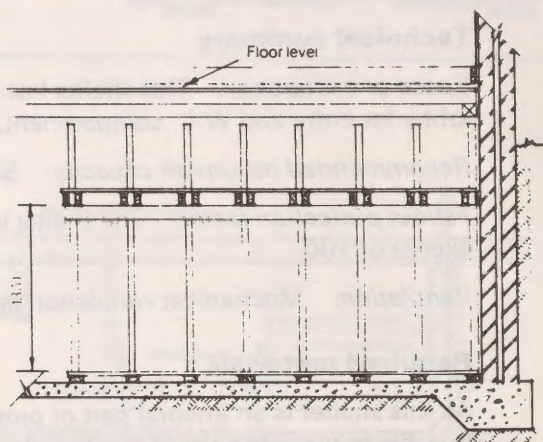
List of required materials

Timber (150 mm × 50 mm)	0.10 m ³
Timber (100 mm × 50 mm)	0.20 m ³
Timber (75 mm × 50 mm)	0.01 m ³
Timber (100 mm × 38 mm)	0.05 m ³
Standard sandbags	No. 240
22 mm chipboard flooring	14.0 m ²

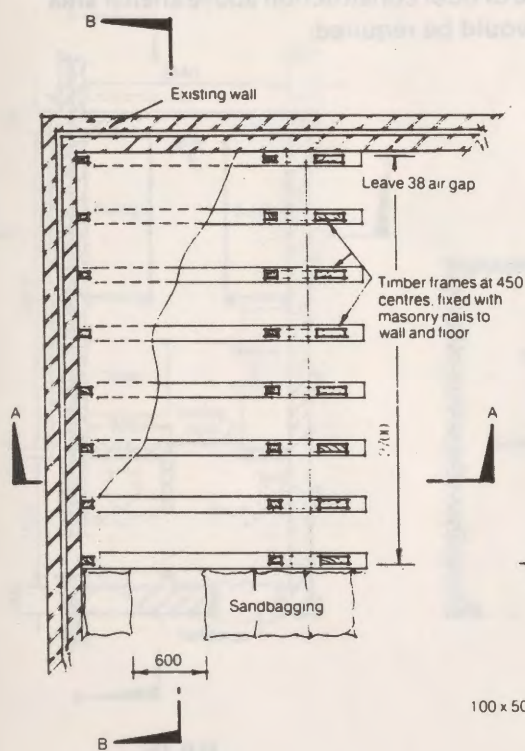
Type G **Timber and sandbags**



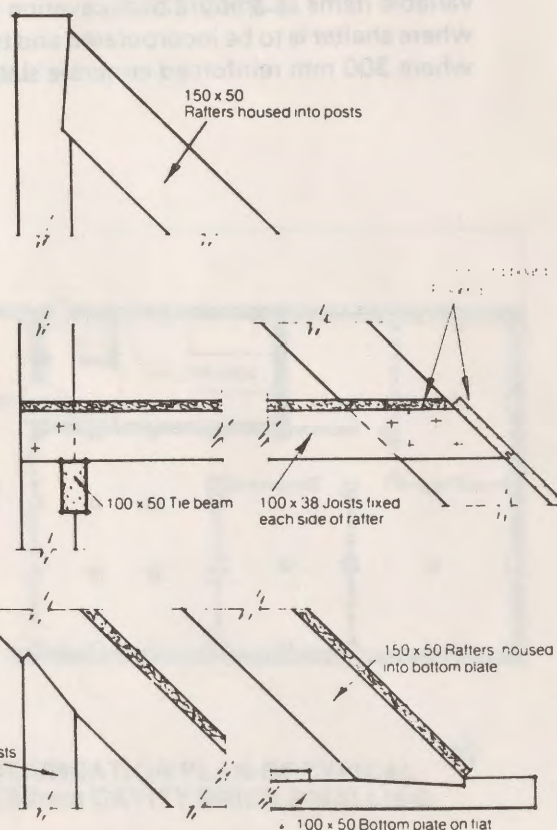
SECTION A-A



SECTION B-B



PLAN



JOINT DETAILS THRO' MEMBERS

Type H Concrete under house

General information

This shelter is designed to provide protection from the effects of radioactive fallout in an under house situation, where the ground has sufficient slope to incorporate a garage.

It is suitable for incorporation in a new dwelling, at original planning stage, and would be erected as part of the new dwelling construction.

Technical summary

Space of occupancy. This shelter has 9.3 m² of floor area, 18.9 m³ of space, plus lobby for entry and W.C. compartment.

Recommended maximum capacity. Six persons.

Fallout protection factor. The shelter is designed to provide a protection factor in excess of 100.

Ventilation. Mechanical ventilation must be provided.

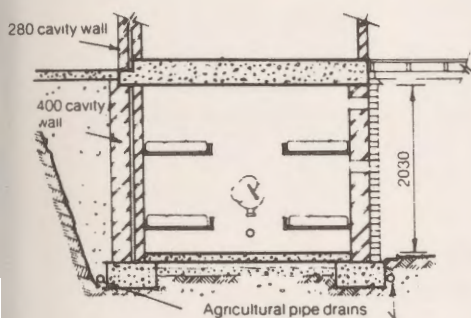
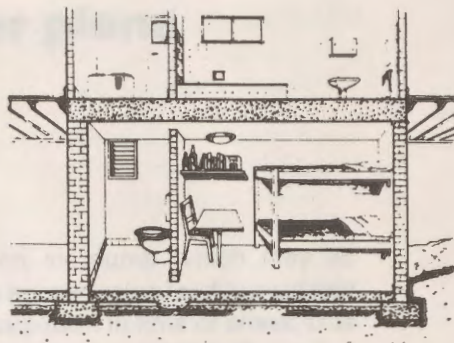
Required materials

As this shelter is an integral part of proposed new dwelling construction, it is not feasible to provide a list of additional materials required.

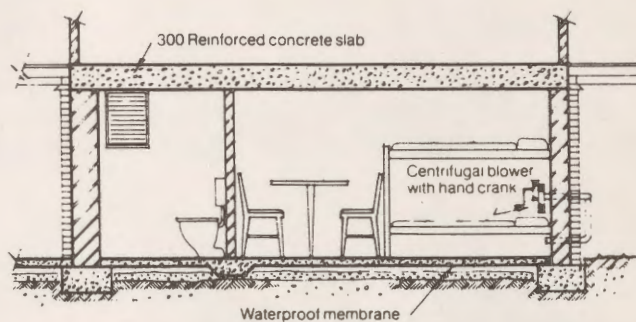
This would largely depend on the floor plan of the new building, including such variable items as amount of excavation required, arrangement of foundation walls where shelter is to be incorporated and type of floor construction above shelter area where 300 mm reinforced concrete slab would be required.

Type H

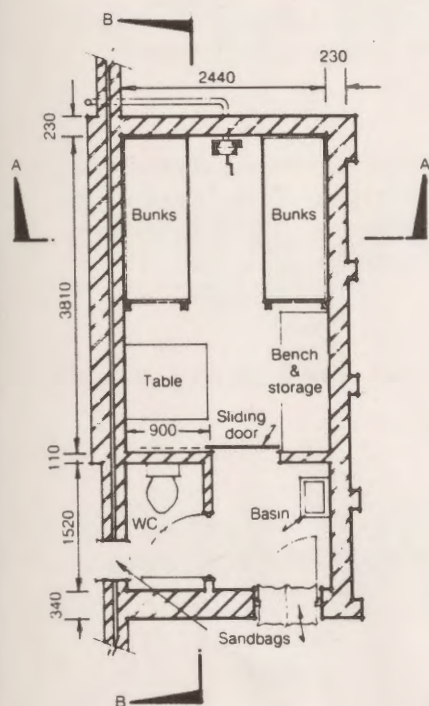
Reinforced concrete floor and ceiling, brick walls



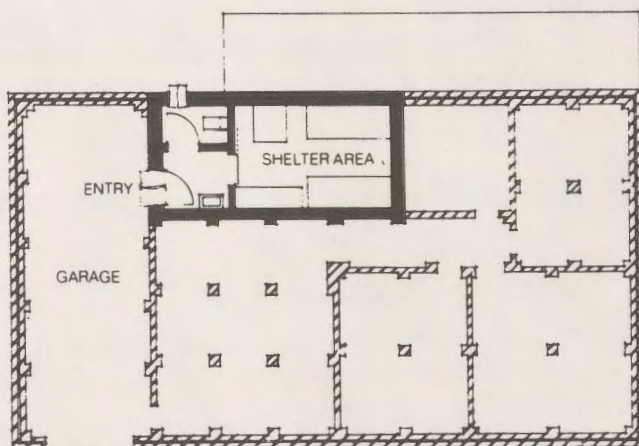
SECTION A-A



SECTION B-B



PLAN



FOUNDATION PLAN OF TYPICAL
280mm CAVITY BRICK DWELLING

Expedient outdoor shelter plans

This section details several fallout shelters and an air pump which may be constructed rapidly and economically by the average person using readily available materials. They are shelters for construction and occupation in time of crises. Due to the variable characteristics of soils throughout Australia the stability of trenches is enormously variable and as these shelters are not engineered structures they should be constructed and used only as emergency fallout shelters.

Door-covered trench shelter

General information

This shelter is designed for areas where there is a shortage of small trees and/or building materials. The depth to groundwater and rock must also be below the bottom of the trench. In addition, the earth must be sufficiently firm and stable so that the trench walls will not collapse. The shelter (3-person capacity) can be constructed by 3 people working an approximate total of 18 hours each. Read and study all instructions before beginning to build.

Step 1

Select a level site and determine the shelter length measuring or laying doors side by side. Do not forget to remove door knobs.

Step 2

Excavate the shelter trench entryway and ventilation trench. At the same time pile the excavated earth at least 900 mm beyond the trench so that it will not interfere with placement of the doors over the open trench. See Figure 1.

Step 3

The walls of the trench must be vertical. With sheets or fabric line the walls of the shelter then place the doors over the open trench as shown on Figure 1.

Step 4

Construct earth rolls or put sandbags around the entryway and ventilation trench in order that the earth can be held in place around both openings. See Figure 2.

Step 5

Place earth fill over the doors. Begin by placing 300 mm deep fill around the edges and compact it with the back of the shovel, then fill over the doors to form a small mound. Place the waterproofing over the mound. Repeat again by placing 300 mm around the edges first and then on the centre. See Figure 3.

Step 6

Construct shallow drainage ditches on all sides and place open side canopies over the openings. See Figure 4.

How to make an earth roll

1. Select a piece of cloth or plastic at least as strong as a new bed sheet, 600 mm wider than the side of the opening to be protected and 1500 mm in length.
2. Place 600 mm of the length of the cloth on the ground, as illustrated.

3. While using both hands to hold up 900 mm of the length of the cloth and while pressing against the cloth with your body, have another person shovel earth onto and against the cloth.
4. While still pulling on the cloth, place the upper part over the earth that is on the lower part of the cloth.
5. Cover the upper edge of the cloth, forming an earth-filled 'hook' in this edge.

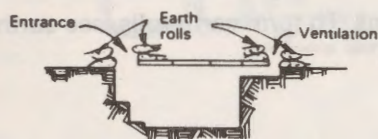
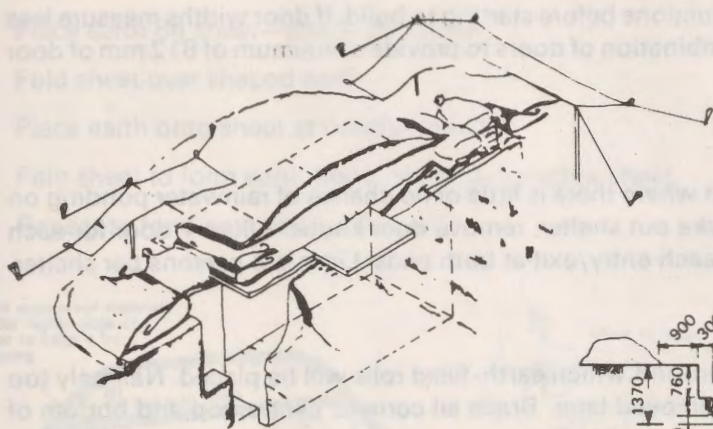


Figure 2

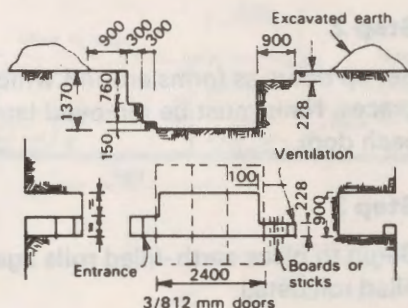


Figure 1
Layout for 3 — person capacity

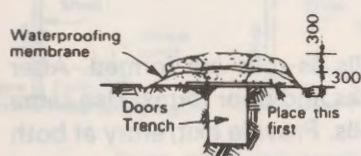


Figure 3

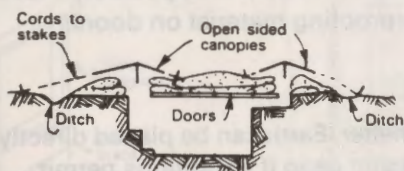
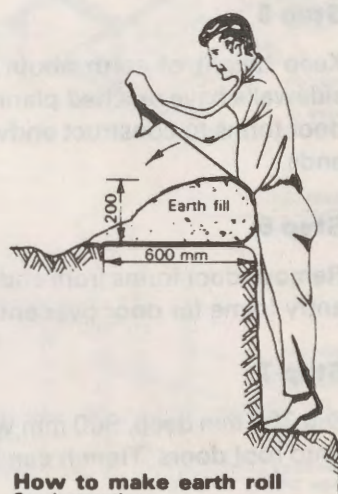


Figure 4



How to make earth roll
See instructions

Above-ground door-covered shelter

General information

The above-ground door-covered shelter is designed for areas where below-ground shelters are impractical because the groundwater table or bedrock is close to the ground surface. This shelter can be built by four persons working a total of 12 hours each.

Read and study all instructions before starting to build. If door widths measure less than 812 mm, use a combination of doors to provide a minimum of 812 mm of door width per person.

Step 1

Select a shelter location where there is little or no chance of rainwater ponding on the ground surface. Stake out shelter, remove door knobs. Allow 1 door for each person plus 1 door for each entry/exit at both ends. Limit is 8 persons per shelter.

Step 2

Set up doors as forms around which earth-filled rolls will be placed. Nail only top braces. Nails must be removed later. Brace all corners, centre, top and bottom of each door.

Step 3

Begin to place earth-filled rolls against door forms. To form earth rolls, see earth-filled roll detail.

Step 4

Mound earth against the earth-filled rolls as shown. Continue placing earth and sheets to form earth-filled rolls.

Step 5

Keep height of earth about equal on both sidewalls as rolls are formed. After sidewalls have reached planned height, remove braces and door forms. Use same door forms to construct endwalls with earth-filled rolls. Provide exit/entry at both ends.

Step 6

Remove door forms from endwalls. Position roof doors in their final position. Place entry frame for door over entry/exit. Place waterproofing material on doors.

Step 7

Dig 355 mm deep, 900 mm wide trench inside shelter. Earth can be placed directly onto roof doors. Trench can be made up to 900 mm deep if conditions permit.

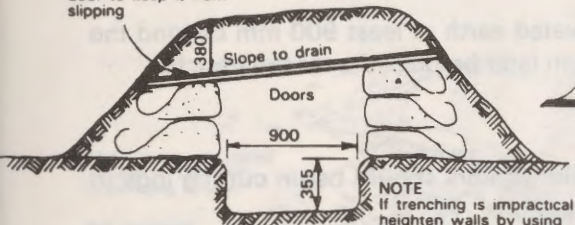
Step 8

Place 380 mm of earth on top of shelter. In hot weather construct a shelter ventilation air pump. See air pump details.

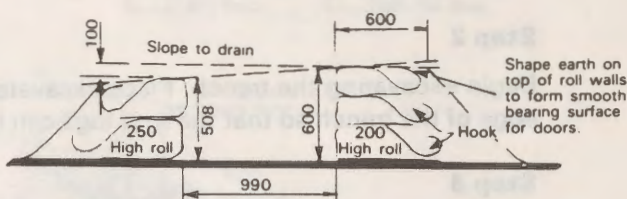
Earth-filled roll detail

1. Place 600 mm of sheet on ground and temporarily drape remainder of sheet on door.
2. Place earth on sheet—shape as shown.
3. Fold sheet over shaped earth.
4. Place earth onto sheet at narrow trench.
5. Fold sheet to form earth hook. Hook will anchor sheet.
6. Repeat to form next earth-filled roll.

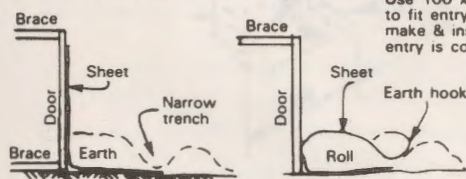
Fold waterproof material under higher edge of door to keep it from slipping



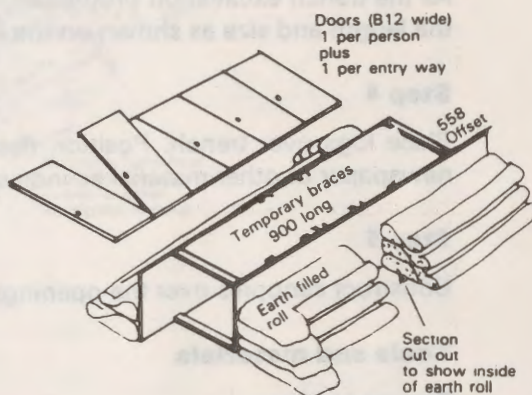
NOTE
If trenching is impractical
heighten walls by using
additional earth rolls.



Shape earth on
top of roll walls
to form smooth
bearing surface
for doors.

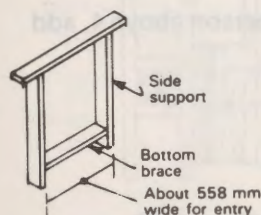


Use 100 x 50 boards
to fit entry way
make & install after
entry is completed

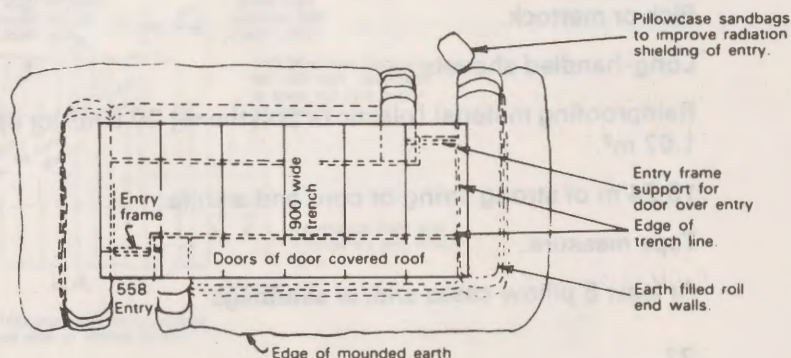


Doors (812 wide)
1 per person
plus
1 per entry way

Earth-filled roll detail



Entry/exit frame
2 required



Plan view of shelter (looking down)

Log-covered trench shelter

General information

This shelter is designed for areas where the depth below the ground surface to hard rock or groundwater is below the bottom of the trench. Also, the earth must be sufficiently firm and stable so that the trench sidewalls will not cave in. In addition, adequate small trees that can be cut for logs must be available in the immediate area. The shelter (4-person capacity) can be built by 4 people working a total of 18 hours each. After initial completion, the shelter can be enlarged to a width of 1676 mm and deepened to 1800 mm. However, 2700 mm logs must be used in place of 2100 mm logs and the buried roof must be large enough to cover the widened shelter during the initial construction.

Step 1

Clear area of brush and tall grass. Layout shelter as shown below.

Step 2

Begin excavating the trench. Place excavated earth at least 900 mm beyond the edge of the trench so that the roof logs can later be placed over the trench.

Step 3

As the trench excavation progresses, some workers should begin cutting logs to the length and size as shown on the illustrations.

Step 4

Place logs over trench. Position ties for bed sheet chairs or hammocks. Place newspaper or other material as indicated over logs. Place earth fill and bury roof.

Step 5

Construct canopies over the openings.

Tools and materials

Saw and/or axe.

Pick or mattock.

Long-handled shovels.

Rainproofing material (plastic or polythene) 20.9 m² for each person above 4, add 1.67 m².

15.24 m of strong string or cord and a knife.

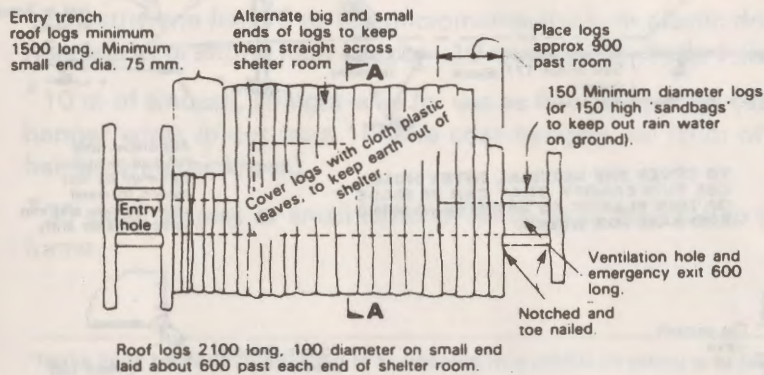
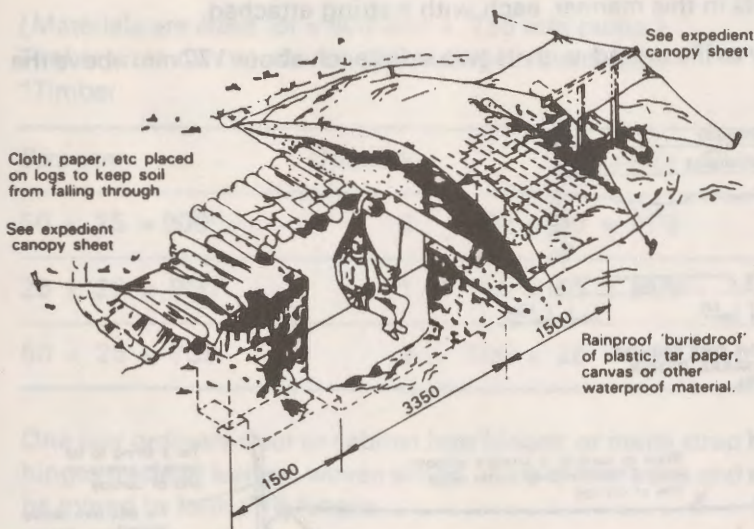
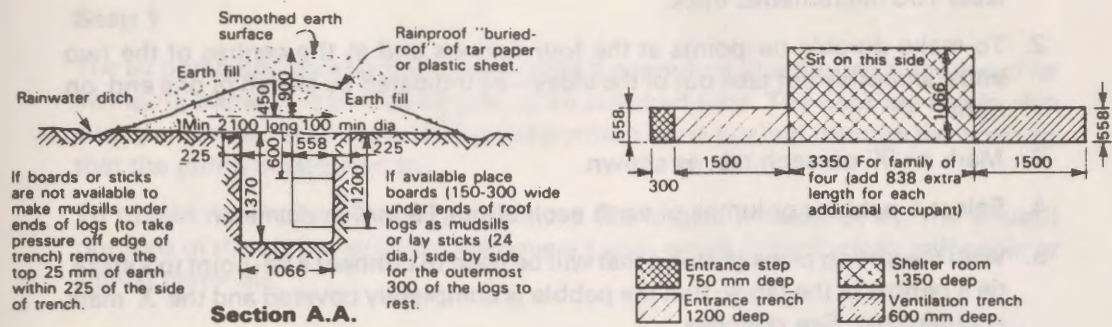
Tape measure.

At least 8 pillow cases and/or sandbags.

Work gloves.

Bed sheets for use as 'chairs' or 'hammocks' —1 per person plus at least 4572 mm of strong rope or cord per bed sheet.

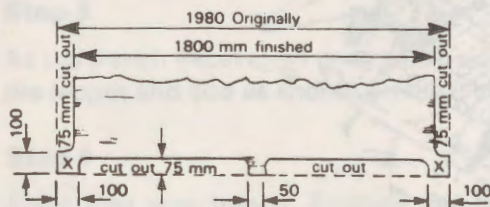
6.8 kg of newspapers to place over roof logs to keep earth from falling through cracks between logs.



Instructions for making a shelter-entry canopy

Directions

1. Cut a piece of plastic 1.98 m by 1.98 m to make a 1.8 m canopy. Use a plastic at least 100 micrometres thick.
2. To make durable tie-points at the four corners and at the centres of the two ends, smoothly cut tabs out of the sides—as indicated by sketch of one end, on right.
3. Mark an 'X' on each tab, as shown.
4. Select 6 pebbles or lumps of earth each about 19 mm in diameter.
5. With the strong piece of string that will be used to connect a tie-point to a stake, tie a pebble in the tab so that the pebble is completely covered and the 'X' mark is outermost. See sketches.
6. Make 6 tie-points in this manner, each with a string attached.
7. Pitch the canopy as illustrated, with its two sides each about 177 mm above the ground.



THREE TABS ON ONE END OF THE CANOPY (MAKE OTHER END THE SAME).

For a 1800 by 1800 canopy drive 2/1200 stakes about 1980 apart.

If in soft or shallow earth, secure the tops of the 2/1200 stakes with guy cords to stakes (not shown).

Tie close to ground.

Rope or cord (or a straight smooth stick 2100 mm long) under ridge line of canopy

Tie a string to tie point in centre of end of canopy.

Tie 685 mm above ground. Enter from this corner.

Nail or notch in stake.

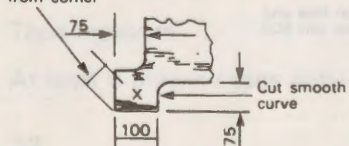
Corner tie point.

Side about 177 above ground.

Adjustable cord not tied to stake, tightened by last person to crawl under canopy and into vertical shelter entry.

TO COVER THE VERTICAL ENTRY HOLE, USE THIS CANOPY, THAT CAN BE MADE OF THIN PLASTIC TO WITHSTAND WIND AND RAIN FOR WEEKS.

Mark "X" 57 mm in from corner



TAB AT CORNER

15 mm Diameter pebble. "X" outermost

Neck tied with string

COMPLETED TIE POINT

IF TIE POINTS ARE MADE AT THE CORNERS WITHOUT FIRST MAKING TABS THE CANOPY WILL HAVE CUPPED IN SIDES THAT CATCH WATER AND WIND.

Air ventilation pump

All *expedient* shelters are designed to provide for some natural ventilation. In very hot weather, additional ventilation may be required to provide a livable temperature. Construction of an air pump that can provide additional ventilation is illustrated over.

Step 1

The air pump operates by being swung like a pendulum. It is hinged at the top of its swinging frame. It is swung by pulling an attached cord. The flaps are free to also swing and when they are in the closed position, air is pushed through the opening that the pump is attached to.

To obtain maximum efficiency and move the largest amount of air, the unused portions of the entryway should be covered with wood, plastic, cloth, stiff paper or similar materials.

Step 2 Materials and tools needed to construct an air pump

(Materials are sized for a 900 mm × 736 mm pump.)

Timber sizes can be altered, depending on availability.

*Timber

<i>Size mm</i>	<i>Quantity</i>	<i>Size mm</i>	<i>Quantity</i>
50 × 25 × 900	2	250 × 25 × 810	2
25 × 25 × 900	1	125 × 25 × 810	1
50 × 25 × 736	2	100 × 25 × 900	1

One pair ordinary door or cabinet butt hinges, or metal strap hinges, or improvised hinges made of leather, woven straps, cords or four hook and eye screws which can be joined to form two hinges.

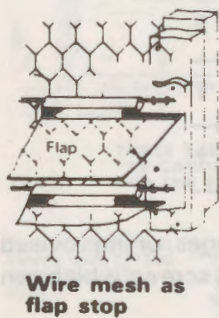
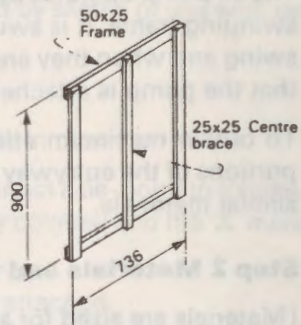
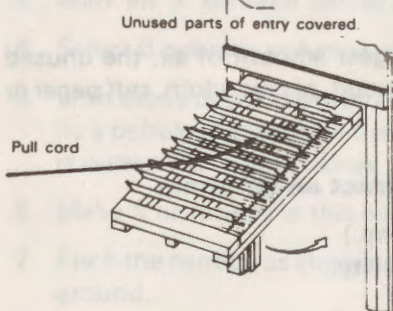
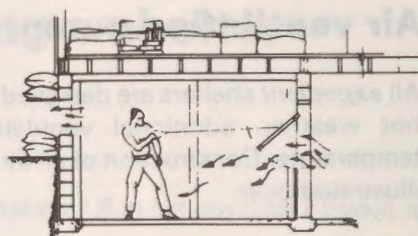
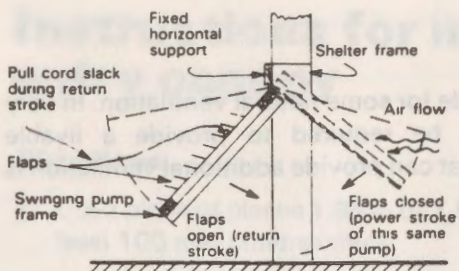
24 nails about 50 mm long, plus screws for hinges.

* Polyethylene film 76 to 100 micrometres thick, or plastic drop-cloth, or raincoat type fabric, or strong heavy paper—10 rectangular-shaped pieces, 760 × 139 mm

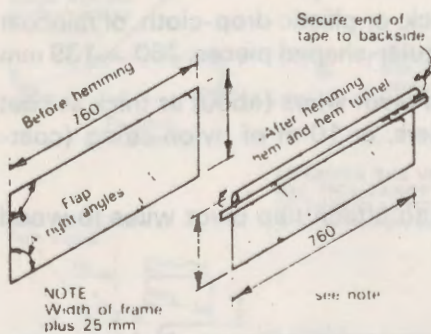
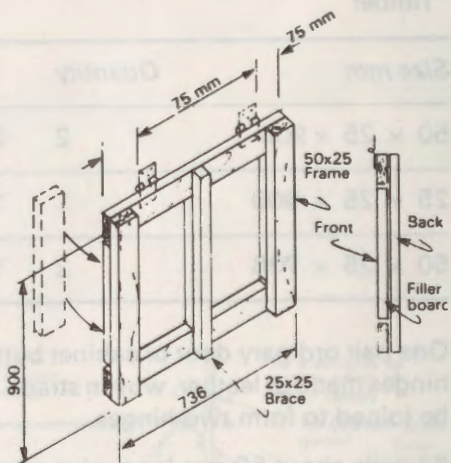
* 10 m of smooth, straight wire for use as flap pivot wires (about as thick as coat hanger wire) or cut from 10 wire coat-hangers, or 10 m of nylon string (coat-hanger wire thickness).

* 30 small staples or small nails, or 60 tacks to attach flap pivot wires to wood frame.

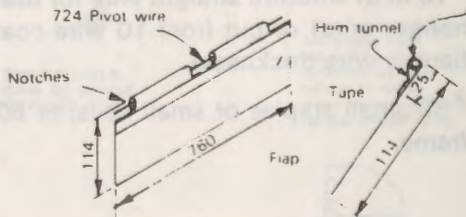
* Items must be sized or adjusted to fit opening into which air pump is to be placed.



Wire mesh as flap stop



Flap pattern



Finished flap

* 9 metres of 19 mm to 25 mm wide pressure-sensitive waterproof tape that does not stretch, or use needle and thread to sew hem tunnels to the flaps.

* For flap stops, 45 m of light string, strong thread, or thin smooth wire, 90 tacks or small nails to attach flap stops to the wood frame, or flap stops can be tied to the frame.

3 metres of cord for the pull cord.

Desirable tools: hammer, saw, wirecutter-pliers, screwdriver, small drill, scissors, knife, yardstick, and pencil.

Step 3 How to construct the air pump

- Cut timber and assemble frame.
- Complete frame and attach hinges. If drill is not available to drill screw holes to attach hinges, use a nail to make the holes.
- Cut 10 rectangular strips 760 mm long $\times$ 140 mm wide for use as flaps; hem flaps as shown. Use pressure-sensitive tape or sew hem to form hem tunnel.

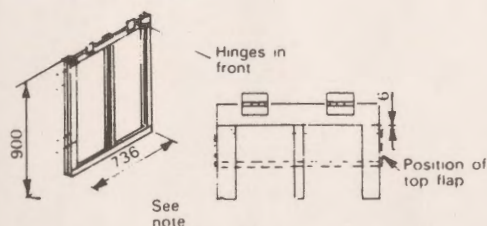
After hem is made, cut notches in flaps as shown. Avoid cutting tape that holds hem.

Insert 10 pieces of straight wire (pivot wires) into flap hem as shown. Flaps should swing freely. String can be used if wire not available (wire coat-hanger thickness).

- Mark pump frame for pivot wire and flap stop locations.
- Attach flap stops (strings or wires) to the pump frame at the marked locations; 4 flap stops are needed between adjacent pivot wires.
- Starting from the bottom-staple nail, tack or tie the flap pivot wires with flaps in their marked positions. Attach hinges to horizontal support boards. Attach pullcord to centre brace.

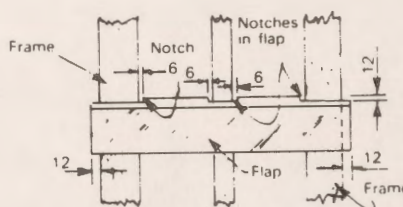
Step 4

Install air pump.



NOTE
Frame dimensions may have to be adjusted to fit opening in shelter

Marking of flap stops



Size of notches in flaps

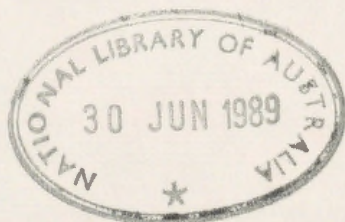
*Items must be sized or adjusted to fit opening into which air pump is to be placed.

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DOMESTIC FALLOUT SHELTER GUIDE